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MOTOR CONTROL SYSTEM

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MOTOR CONTROL SYSTEM

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Claim

A type of motor control system characterized by the following facts:

in this motor control system, velocity control of a DC motor is carried out using a digital control system based on the pre-stored motor constant data;

in this motor control system, there are the following means: a test operation control means that performs test operation for said DC motor based on the initial value data of said motor constant data in the test mode, a velocity deviation value-computing means that computes the velocity deviation value corresponding to the variation portion depending on the variation of the ambient environment in the test operation of said DC motor, an operation data-forming means that forms the motor constant data for the operation mode from the velocity deviation value computed using said velocity deviation value-computing means and said initial value data when change takes place from said test mode to the operation mode, and a driving control means

that drives said DC motor based on the motor constant data for the operation mode formed using said operation data-forming means in the operation mode.

Detailed explanation of the invention

Technical field of the invention

The present invention pertains to a motor control system of DC motor using a digital servo control system.

Technical background of the invention and problems to be solved

In the prior art, for example, in an optical character reader (OCR), a DC motor is used as the driving source of the transporting device for transporting the slip to a scanning part. This is because the DC motor has a relatively high rotating velocity and a high torque, and it allows easy control of the velocity.

In recent years, the digital control system has been adopted in the servo control of the DC motor. In this motor control system, a microprocessor (CPU) is used as the controller, with a table of the motor constant data corresponding to each velocity value stored in the memory. Based on the memory table, the CPU forms the control variable corresponding to the pulse time width, and sends it to a motor drive. The motor drive feeds a driving current corresponding to the pulse time width to the DC motor.

However, in the aforementioned motor control system, when constant-velocity control is performed for the DC motor, at the initial time of transition from the accelerating state to the constant velocity state, the motor is driven on the basis of a prescribed motor constant. Then, by monitoring the velocity of the motor, the servo control of the motor is realized. However, when there is a significant variation in the ambient environment of the DC motor, in the initial stage of the constant velocity control, the servo control of the DC motor may not be fully operational. In this case, the variation of the ambient environment may be a temperature difference in a wide range, and the mechanical load, especially that at a low temperature, may increase. It is believed that this is due to the fact that with the motor constant set in the initial stage, the variation in the ambient environment of the DC motor cannot be absorbed.

Objective of the invention

The objective of the present invention is to solve the aforementioned problems of the prior art by providing a type of motor control system characterized by the fact that in the digital servo control of a DC motor, stable velocity control can be realized even when there is significant variation in the ambient environment of the DC motor as transition is made from an acceleration state to a constant velocity state.

Summary of the invention

According to the present invention, there is a test operation control means for making test operation of the DC motor based on the initial value data of the motor constant data in the test mode. A velocity deviation value-computing means computes the velocity deviation value corresponding to the variation portion depending on the variation in the ambient environment in the test operation of the DC motor. An operation data-forming means forms the motor constant data for the operation mode from the velocity deviation value computed using said velocity deviation value-computing means and said initial value data when change takes place from said test mode to the operation mode. A driving control means drives said DC motor based on the motor constant data for the operation mode formed using said operation data-forming means in the operation mode.

With this motor control system, in the test mode, it is possible to form the motor constant data for the operation mode that can absorb the variation portion corresponding to variation in the ambient environment of the DC motor in the test mode.

Application examples

In the following, the present invention will be explained in more detail with reference to an application example illustrated by figures. Figure 1 is a block diagram illustrating the constitution of the motor controller in the application example. DC motor (10) has a rotary encoder, and it outputs encoded pulses EP corresponding to the rotation. After shaping/discriminating circuit (11) performs shaping/discriminating of encoded pulses EP output from DC motor (10), the pulse is output to motor velocity detector (12). Motor velocity detector (12) counts the interval of encoded pulses EP from said shaping/discriminating circuit (11), and detects the rotating velocity of DC motor (10).

23 Control part (13) is composed of a microprocessor. In the test mode, the velocity deviation value as the variation portion corresponding to the variation in the ambient environment of DC motor (10) is computed, and, in the operation mode, the motor constant data is formed from the pre-stored initial value in the operation mode and the velocity deviation value computed in the test mode. Control part (13) outputs driving pulse DP formed from the motor constant data to motor driver (14). Motor driver (14) feeds a driving current corresponding to driving pulse DP to DC motor (10).

The velocity deviation value computed using control part (13) is stored in memory (RAM) as deviation value distribution storage part (15). The initial value is stored in initial value memory (ROM) (16) beforehand. The motor constant data prepared using control part (13) is stored in motor constant memory (RAM) (17). Clock generator (18) outputs the clock pulses needed for the various operations to motor velocity detector (12) and control part (13).

In the following, an explanation will be given regarding the operation of said application example with reference to Figures 2-4. First of all, control part (13) executes the test mode, and performs the operation of setting the motor constant data needed in the conventional operation mode. On the basis of the initial value data pre-stored in initial value memory (16), control part (13) makes DC motor (10) perform the test operation. As DC motor (10) rotates and drives, said encode pulses EP is output from the rotary encoder. Motor velocity detector (12) counts the pulse interval of encode pulses EP by counting the clock pulses from clock generator (18). As a result, it is possible to detect velocity V of DC motor (10). Velocity V detected in this way is represented as curve (30) in Figure 3. Here, as shown in Figure 3, velocity data V is determined from the number of clock pulses counted. Consequently, the variation in velocity data V is reverse that of actual velocity (80).

As shown in Figure 3, suppose DC motor (10) starts rotating at time T_0, the pulse time width of driving pulses DP in this case is PTw. Control part (13) monitors velocity V of DC motor (10), and, when the velocity goes over a prescribed monitoring velocity (Vi – ΔVi), it judges that the velocity of DC motor (10) has reached the prescribed level (time Tc in Figure 3).

Then, as shown in Figure 3, variation in velocity ΔVj corresponding to variation in the ambient environment is determined with respect to prescribed constant velocity Vi of DC motor (10). Here, as shown in Figure 4(a), the table of the initial value data is stored in initial value memory (16). The initial value data corresponds to pulse time width PTiw of driving pulses DP with respect to prescribed constant velocity Vi of DC motor (10). Control part (13) computes pulse time width ΔPTw corresponding to velocity variation ΔVj according to the following formula (1).

$$\Delta PTw = K (G \cdot \Delta Vj + M \cdot \Delta m + J \cdot \Delta n) \quad \cdots (1)$$

where, K, G, M, J are constants; Δm is "Vj – V(j – 1)", and Δn is "ΣΔVj".

As control part (13) computes ΔPTw using said formula (1), and the distribution at the sampling point in the test mode is determined. That is, control part (13) counts case number N at the same ΔPTw in the test mode, and, as shown in Figure 2, it stores the distribution state in deviation value distribution storage part (15). In this case, at the various sampling points in the test mode, initial value PTiw is used, and "PTiw + ΔPTw" is taken as the motor constant data (PTw) of the next sampling point.

In this way, when the test mode comes to an end, control part (13) determines ΔPTiw having maximum case number N from deviation value distribution storage part (15). Control part (13) computes constant velocity motor constant data from ΔPTiw from deviation value

distribution storage part (15) and initial value data PTiw from initial value memory (16). This constant velocity motor constant data "ΔPTiw + PTiw" is stored in motor constant memory (17) in the state shown in Figure 4(b). Then, control part (13) switches the mode from the test mode to the operation mode, and drives DC motor (10) to rotate. In this case, control part (13) reads constant velocity motor constant data determined in the test mode from motor constant memory (17). Based on the data, DC motor (10) rotates at constant velocity Vi. That is, control part (13) outputs driving pulse DP having a pulse time width corresponding to constant velocity motor constant data (ΔPTiw + PTiw) to motor driver (14). Motor driver (14) feeds a driving current corresponding to the pulse width of said driving pulse DP to DC motor (10). As a result, even when variation takes place in the ambient environment, DC motor (10) still can rotate at a stable constant velocity because it is driven based on the constant velocity constant data [ΔPTiw + PTiw] that contains the variation portion.

Effect of the invention

As explained in detail above, according to the present invention, in the digital servo control of the DC motor, as rotation is performed on the basis of the initial value data in the test mode, it is possible to determine the variation portion corresponding to variation in the ambient environment. Consequently, for example, when transition is made from an accelerating state to the constant velocity state, even when there is significant variation in the ambient environment of the DC motor, it is still possible to realize stable velocity control by performing driving control of the DC motor with the initial value data and the variation portion.

Brief description of the figures

Figure 1 is a block diagram illustrating the constitution of the motor controller in an application example of the present invention. Figures 2 and 3 are diagrams illustrating the characteristics of the operation in said application example. Figures 4(a), (b) illustrate the operation of said application example. Figure 4(a) shows an example of the stored contents in the initial value memory, and Figure 4(b) shows an example of the contents stored in the motor constant data memory.

10 DC motor
12 Motor velocity detector
13 Control part
14 Motor driver
15 Deviation distribution storage part
16 Initial value memory

17 Motor constant data memory

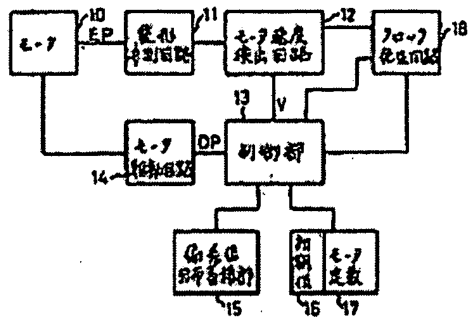

Figure 1

Key: 10 DC motor
11 Shaping/discriminating circuit
12 Motor velocity detector
13 Control part
14 Motor driver
15 Deviation distribution storage part
16 Initial value memory
17 Motor constant data memory

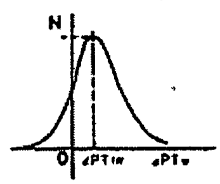

Figure 2

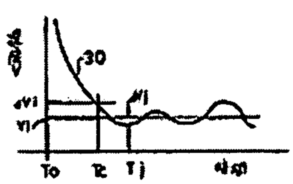

Figure 3

Key: 1 Velocity V
2 Time

V	PTw
V1	PT1w
V2	PT2w
⋮	⋮
Vi	PTiw

(a)

V	PTw
V1	PT1w
V2	PT2w
⋮	⋮
Vi	PTiw+ΔPTiw

(b)

Figure 4